Final Report
Mars Data Analysis Program
NAGS-9590
Characterizing the Oxidizing Properties of Mars' Polar Regions

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This project had two primary goals. The first was to restore and archive the Ultraviolet Spectrometer (UVS) data from the 1971 Mariner 9 (MM71) mission to Mars. The second was to use this revised data set to analyze data of Mars' polar regions to look for and map out the ozone (O_3) and hydrogen peroxide (H_2O_2) features.

Data restoration and archiving activities for this project have resulted in the restoration of 100% of the original Mariner 9 raw data set as well as many of the secondary analysis data sets. These data sets have been submitted to the Planetary Data System (PDS) Atmospheric Node, long with their PDS labels and descriptive metadata.

These data have also been placed on a new, LASP web site for easy reference and downloading (see http://lasp.colorado.edu/mariner_9_data). This allows other researchers easy access to the data for analysis and comparison.

In addition, a useful visualization and analysis tool has also been developed which allows the user to compare these Mariner 1971 Ultraviolet spectral data with several choices of related data sets: Mariner 9 images, USGS geologic data, MGS MOLA topography, Viking images (Viking MDIM) and thermal inertia data (MGS TES). (See http://lasp.colorado.edu/albatross.)

Preliminary analysis of the Mars polar data was presented in July 2000. We find, using just a subset of the entire database, relatively large amounts of ozone and small amounts of peroxide are measured at the winter pole, while relatively large amounts of hydrogen peroxide and small amounts of ozone are found at the summer pole. The ozone and peroxide are thus anti-correlated. These results were obtained using a method proven to be useful in analysis of Jupiter icy satellite data from the Galileo UVS (Hendrix *et al.*, 1999). The UVS spectra were modeled using laboratory spectra of hydrogen peroxide (Carlson *et al.*, 1999) and the ozone cross section. Varying combinations of O_3 and H_2O_2 were tried in the model to achieve the best fit to the Mars spectra. The presence of H_2O_2 at the polar cap suggests that it may also be present in the martian soil, which is

significant because Viking lander results indicate that an oxidant is likely present at the Mars surface, but so far none has been detected. The anti-correlation between Mars' ozone and hydrogen peroxide is consistent with the idea that hydrogen peroxide contributes to the destruction of ozone (Hunten, 1974), so this result is also important in understanding the CO_2-H_2O-O_3 cycle on Mars. It had been noted in early analysis of MM71 UVS data (Barth and Dick, 1974), that more ozone is present during periods of lower temperature and lower water vapor amounts. This new result indicates that the ozone amounts may have less to do with water vapor abundances than with the related H_2O_2 abundances.

The above results were obtained using data from just three MM71 orbits. These results will be expanded by analyzing the entire MM71 UVS dataset. We can now use the Albatross software (see above) to look for additional observations in regions of interest that exist in the MM71 database. This software plots the MM71 FOV onto a map of Mars for a selected latitude-longitude range. The user can then go into the database to extract the spectra for the times associated with those footprints.